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Physico-Chemical Properties of Onion Powder as Affected by Drying Methods

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Abstract: Onion is one of the important crop grown in Pakistan. This study was conducted to develop the onion powder and assess the effect of different drying methods on onion powder quality. Onions were dried through three different drying methods i.e. open sun drying, solar cabinet drying and dehydration method to develop the suitable drying method for the production of onion powder and study the application of that in food preparation. Quality of onion powder was based on nutritional evaluation. The acceptability of onion powder was tested by sensorial attributes. The greater drying rates shorter drying time were observed in dehydrated onion powder sample as compared to open sun dried and solar cabinet dried onion powder. Dehydration method for onion drying is best among all three drying methods to maintain natural color as well as nutrients.

Key words: Onion powder, drying method, open sun drying, solar cabinet drying, dehydration, proximate composition, sensory evaluation.

1. INTRODUCTION

Onion (*Allium cepa*L.) is the most significant vegetable crop used as a spice and food ingredient because of its aroma, flavor, and pungency. It is a widely used crop globally, mainly because it has many health advantages. It has wound healing, medicinal, antioxidant and antimicrobial properties including trypsin and tyrosinase prevention properties (Sharma *et al*., 2014). Onion has several health benefits; onion has been traditionally used as a medicine in Ethiopia and different parts of the world. Onion may defend against cancer, it may also fight against fungi and bacteria, helped in cardiovascular health, insulin resistance and decrease hypertension, helped in weight loss, have antioxidant activity, and fight chronic bronchitis, infections and fever (Dinkecha and Muniye 2017). Onion has positive medicinal and disease prevention capability, because of its hypocholesterolemic, thrombolitic and antioxidant effects Onion aid as a good medicinal compound for cataract, cancer, and CVD (cardiovascular disease) (Nuutila, *et al*., 2003). Onion has high initial moisture content about 88% so may be considered as perishable vegetable. Onion deterioration takes place due to the microbes, enzymatic degradation, and vinegar flies (Revaskar, *et al*., 2007). Onion is consumed throughout the year but its production is seasonal and yield depends upon the climatic conditions which causes shortage of onion in the market (Bari, 2003).

Drying is the traditional techniques of food preservation accomplished to increase shelf life of food products. Recently new and modern techniques that increase drying ratio and enhance dried onion quality attribute are obtaining important attention (Mongpraneet, *et al*., 2002). The most crucial challenge throughout drying of food materials is to reduce moisture level of the food material without affecting of product quality such as color, flavor, taste and nutrients (Arslan and Musa, 2010). The most important quality attribute is color that affecting its visual appearance. Through effect of drying deterioration of color has an adverse impact on costumer acceptability. However, Chemical changes can be take place duringdrying process, which may cause changes in color. It is most important during drying of onion to retain quality parameter of product (Shitanda and Wanjala, 2006; Dadali, *et al*., 2007). The present investigation was carried out with the following objectives in order to study the effect of different drying methods on proximate and sensorial properties of onion.

2. MATERIAL AND METHODS

Onion was collected from farmer field at Nasarpur (nasarpuri variety) for experimental work. Onions were peeled and cut into slices. Onion slices were immersed into 0.2% KMS (potassium metabisulphite) solution for 5 minutes at room temperature to improve color and enhance shelf life (Raj *et al*., 2006; Sutar, *et al*., 2007).

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Treated onion slices were spread up on aluminum trays in a single layer and dried by three different drying methods.

1. Open Sun Drying: - onion slices were dried through direct sunlight.
2. Solar Cabinet Drying: - Onion slices were dried in a solar cabinet dryer.
3. Thermal Dehydration: - Onion slices were dried in a dehydrator at 65 °C for 14-16 hours.

During drying after every 2 hours the onion slices sides were changed and being continuously monitored. After drying dried onion flakes were grinded until fine powder was obtained. The onion powder samples were packed into glass bottles and stored at room temperature for further sensory evaluation and proximate composition analysis.

Sensory evaluation

The sensory quality of raw and cooked onion powder was recorded in order to assess color, appearance,
flavor, texture, aroma and overall acceptability by panelists using 9-point hedonic scale (Larmond, 1977).

Cooking Methodology for Sensory Analysis

The materials used for the preparation of the instant curry mix were ginger, garlic, red chili powder, onion powder, turmeric, salt, yogurt, cumin seeds, tomato and oil were procured from local market. Washed fresh chicken meat with water, dipped in yogurt for 3 minutes to give taste and tenderness. Boneless chicken pieces were marinating with mixture of ingredients and kept for 20 hours at 4±1°C. Spices ingredients used according to home recipe for chicken curry from onion powder paste were with alteration for formulation of self-stable spice mixture.

Proximate composition

Physico-chemical analysis including moisture, fat, protein, titratable acidity, vitamin-C, pH value, TSS, ash, crude fiber, total carbohydrates and energy value were estimated by employing the standard method of analysis (AOAC, 2000). Calcium, potassium, phosphorus and sulfur were estimated byatomic absorption spectrometer Hitachi model A-1800 according to the method of Ecrement and Burell (1973).

Statistical analysis:

The data was obtained, tabulated and analyzed according to statistical procedure of analysis of variance (ANOVA) and significant differences of the mean was further computed by the method as described by Gomez and Gomez, (1984) using least significant difference (LSD) at 0.05% level of probability.

4. RESULTS AND DISCUSSION

The composition of fresh onion is presented in **(Table 1).** The results of onion powder such as moisture, fat, protein, titratable acidity, crude fiber, total carbohydrates, ascorbic acid, pH, ash energy value and TSS shown in **(Table 2).**The drying temperature has significant effect on drying time. The moisture content was remained significantly different ($P < 0.05$) in different dried onion powder i.e. open sun dried, solar cabinet dried and dehydrated onion power. The moisture content ranged between 4.90 and 7.05 percent. The lower moisture content was observed in dehydrated onion powder. Sorour and Mesery (2014) also reported moisture content of onion powder in range of between 7.00 to 7.30 percent. The fat content range was 0.64 to 0.82 percent. The higher protein content was recorded in dehydrated onion powder 7.00 percent. The similar fat and protein results also reported by Sangwan, *et al*. (2010). The T.A significantly was varied ($P < 0.05$). The higher crude fiber 4.43 percent was in dehydrated onion powder and higher total carbohydrates 80.44 percent were recorded in open sun dried onion powder. The ascorbic acid was in the ranged 6.19 to 11.09 mg/100g. The pH value and ash were significantly varied ($P < 0.05$) in different dried onion powder. The higher energy value and TSS (total soluble solids) were recorded in dehydrated sample. The variation between results might be due to drying of onion by different drying techniques.

The average results of calcium, potassium, phosphorus and sulfur content are given in **(Table 3).** The results were non-significantly ($P > 0.05$) different from each other.

Table 1: Composition of fresh onion

Parameters	Mean
Moisture (%)	86.75 ± 0.21
Fat (%)	0.30 ± 0.1
Protein (%)	1.22 ± 0.17
Titratable acidity	0.04 ± 0.01
Vitamin-C (mg $100g^{-1}$)	11.84 ± 0.56
pH (value)	6.06 ± 0.03
TSS (°Brix)	16.35 ± 0.1
Ash (%)	0.38 ± 0.02
Crude fiber (%)	0.56 ± 0.09
Total carbohydrates (%)	10.77 ± 0.22
Energy value (kcal $100g^{-1}$)	43.97 ± 0.38
Calcium (mg $100g^{-1}$)	16.65 ± 0.35
Potassium (mg $100g^{-1}$)	27.90 ± 0.4
Phosphorus (mg $100g^{-1}$)	33.30 ± 0.3
Sulfur (mg $100g^{-1}$)	43.55 ± 1.25

Values are Mean ± SE of three replicates

Table 2: Proximate composition of onion powder prepared by different drying method

Onion powder	OSP[1]	SCD[2]	DH[3]	LSD at 0.05 %	S.E.±
Moisture	7.04±0.13 A	7.05±0.54 A	4.90±0.00 B	0.6448	0.2322
Fat	0.74±0.02 B	0.82±0.01 A	0.64±0.01 C	7.56E-03	2.72E-03
Protein	5.07±0.17 C	6.12±0.17 B	7.00±0.35 A	0.6871	0.2475
T.A	0.05±0.00 C	0.07±0.00A	0.06±0.00 B	3.93E-03	1.41E-03
Crude fiber	3.49±0.12 B	3.05±0.24 B	4.43±0.45 A	0.841	0.3029
Total CHO	80.44±0.15 A	79.74±0.47 B	79.80±0.10 B	0.455	0.1639
Ascorbic acid	9.96±0.58 A	11.09±0.94 A	6.19±0.07 B	1.3285	0.4785
pH	5.47±0.02 B	5.60±0.09 A	5.52±0.00 AB	0.1102	0.0397
Ash	3.20±0.01 A	3.19±0.01 A	3.21±0.02 A	0.0433	0.0156
Energy value	305.74±0.29 B	306.52±1.38 AB	307.36±1.34 A	1.4078	0.5071
TSS	14.62±0.41 B	14.02±0.10 C	15.10±0.21 A	0.3563	0.1283

Values are Mean ± SE of three replicates

Table 3: Calcium, potassium, phosphorus and sulfur content (mg/100g) of onion powder prepared by different drying method

Onion powder	Calcium	Potassium	Phosphorus	Sulfur
OSP[1]	18.95±0.25 B	35.00±0.2 A	24.95±0.25 C	34.65±0.75 A
SCD[2]	21.50±0.2 A	28.90±0.4 C	26.10±0.2 B	32.40±0.70 B
DH[3]	15.70±0.2 C	33.05±0.35 B	28.95±0.15 A	30.20±0.6 C
LSD at 0.05%	0.5591	0.7547	0.1133	0.1745
S.E.±	0.2014	0.2718	0.0408	0.0629

Values are Mean ± SE of three replicates

Table: 4 Sensory analysis of raw onion powder prepared by different drying method

Onion powder	Color	Appearance	Flavor	Texture	Aroma	Overall acceptability
OSP[1]	6.70±0.42 C	6.75±0.79 B	6.85±0.88 B	6.30±0.94 C	6.40±0.56 C	6.50±0.57 A
SCD[2]	7.15±0.57 B	6.92±0.37 B	7.05±0.55 B	7.05±0.49 B	7.25±0.92 B	7.85±0.66 A
DH[3]	8.00±0.52 A	8.70±0.48A	8.50±0.52 A	8.70±0.48 A	8.50±0.70 C	8.70±0.48 A
LSD at 0.05%	0.3466	0.5556	0.6437	0.6270	0.6950	0.5949
S.E.±	0.1650	0.2644	0.3064	0.2985	0.3308	0.2832

Values are Mean ± SE of ten replicates

Table 5: Sensory analysis of cooked onion powder (in form of Chikenqorma) prepared by different drying method

Onion powder	Color	Appearance	Flavor	Texture	Aroma	Overall acceptability
OSP[1]	7.75±0.54 AB	7.35±0.66 B	7.90±1.10 A	7.70±1.15 A	6.90±0.73 B	7.70±0.82 A
SCD[2]	7.45±0.68 B	7.40±1.07 B	7.95±0.68 A	7.60±0.96 A	7.60±1.17 AB	7.85±1.15 A
DH[3]	8.20±0.78 A	8.15±0.74 A	7.55±0.76 A	8.00±0.84 A	7.85±0.94 A	8.05±0.83 A
LSD at 0.05%	0.6820	0.6760	0.8544	0.8615	0.8945	0.7362
S.E.±	0.3246	0.3217	0.4067	0.4101	0.4258	0.3504

Values are Mean ± SE of ten replicates

The sensory analysis scores of raw onion powder and cooked onion powder are presented in (Table 4-5).The finding results revealed that onion powder is highly acceptable by panelist. The dehydrated onion powder was good sensorial properties such as color, appearance, flavor, texture, aroma and overall acceptability. The dehydrated onion powder has higher sensory scores in order to raw and cooked onion powder.

4. CONCLUSION

Onion dehydration helps to decrease the weight and bulk of material by significant amounts and improves the efficiency of product transportation and storage. Dehydration is the quickest method of drying because open sun drying and solar cabinet drying method take more time for drying and depend upon weather condition. Dehydration is best process among the all drying methods. Developed of onion powder can prevent huge wastage make it available in off season round the year at remunerative prices. The onion powder can be exported after drying / dehydrated every year.

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